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# Virtual Integration Platforms and Sensor Models in the Context of ADAS Functions Performance Testing & Validation

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*Keywords:* Type your keywords here, separated by semicolons ;

## 1. Main text – Extended Abstract

In the Automotive industry and especially in the ADAS domain, functions like “Vehicle Detection”, “Lane Detection” undergo a very costly and time-consuming validation process before their final deployment in the vehicle. After the completion of the development process, image based detection algorithms usually rely on huge data sets of previously recorded data for performance testing and validation. Though vision data sets like “KITTI Vision Benchmark Dataset” and others are currently available for public use, there still lies numerous requirements that need to be satisfied and steps that need to be followed in order to pave the way for a proper and meaningful use of the recorded data sets in the scope of image based function testing and validation. Using the publicly available recorded data may be in some cases a good starting point but as we all know sooner or later we will need a more customized/personalized recorded data sets that capture more precise and detailed specifications like the camera’s technical specifications or even its mounting position in the car. Furthermore, depending on the image based function under investigation, recorded data should also reflect certain driving scenarios in specific environmental conditions (rain, snow, fog, at sun rise, at daytime, at night ...) or specific driving parameters like, speed, acceleration, grip, car orientation, position in lane, etc. that that may be too hard to safety due to safety, financial restrictions or even time limitations.

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1.1. Research objectives

By exploring the possibilities of modeling and simulation we aim to investigate their feasibility in the ADAS domain as a more flexible approach in performance testing and validation for image based functions. Our aim extends to cover two main approaches for image based functions performance testing and validation via:

1. The usage of integration platforms for directly generating virtual test scenarios.  
Here we aim to generate virtual test scenarios by directly making use of the integration platform on hand without any further 3<sup>rd</sup> party models implementation.
2. The usage of generated sensor models coupled with integration platforms for generating virtual test scenarios.  
This is a more advanced approach where it implies the usage of a sensor model, a camera sensor model in our case, implemented in an integration platform to generate more realistic testing scenarios, video data streams in this case.

1.2. Methodological approach

In order to satisfy our proposed objectives, we reach out to several state of the art Co-Simulation approaches available for us today. Via implementing the image based function under consideration in a **Functional Mockup Unit (FMU)** and by ensuring its compatibility with the **Open Simulation Interface (OSI)** our **Open Simulation Functional Mockup Unit (OFU)** with the image based function integrated in it assures the portability and the flexibility of our design.

To satisfy our first objective we first need to start testing the feasibility of using virtual test scenarios for functions performance testing and validation. Figure 1 illustrates our suggested workflow where we can see that at the end of the process generated object lists from real recorded data and from virtual test scenarios are brought up together for comparison and further analysis.

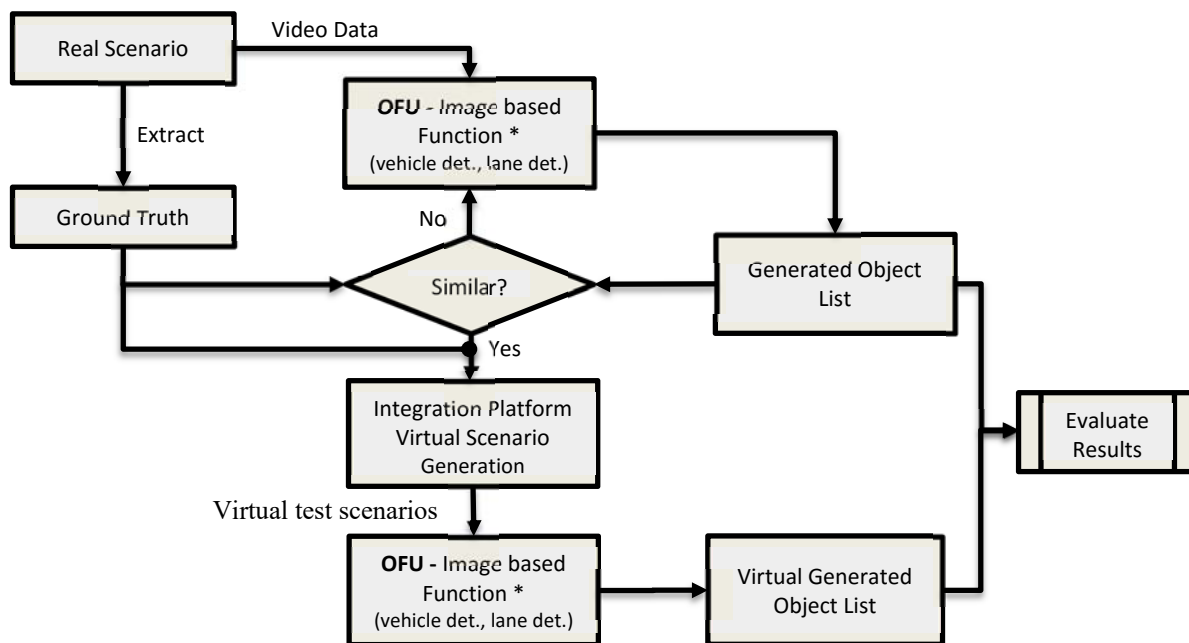


Fig. 1 Integration platforms for directly generating virtual test scenarios

In order to satisfy our next objective “*The usage of generated sensor models coupled with integration platforms for generating virtual test scenarios*”, we adapt a slightly modified but crucial approach to that illustrated in figure 1. In this case we require to have a sensor model, camera sensor model in our case. Implemented between the “*Virtual Scenario Generation*” and “*OFU- Image based Function\**” blocks the camera sensor model is also implemented as a *OFU* with the scope of providing a more realistic video data stream to the image based function.

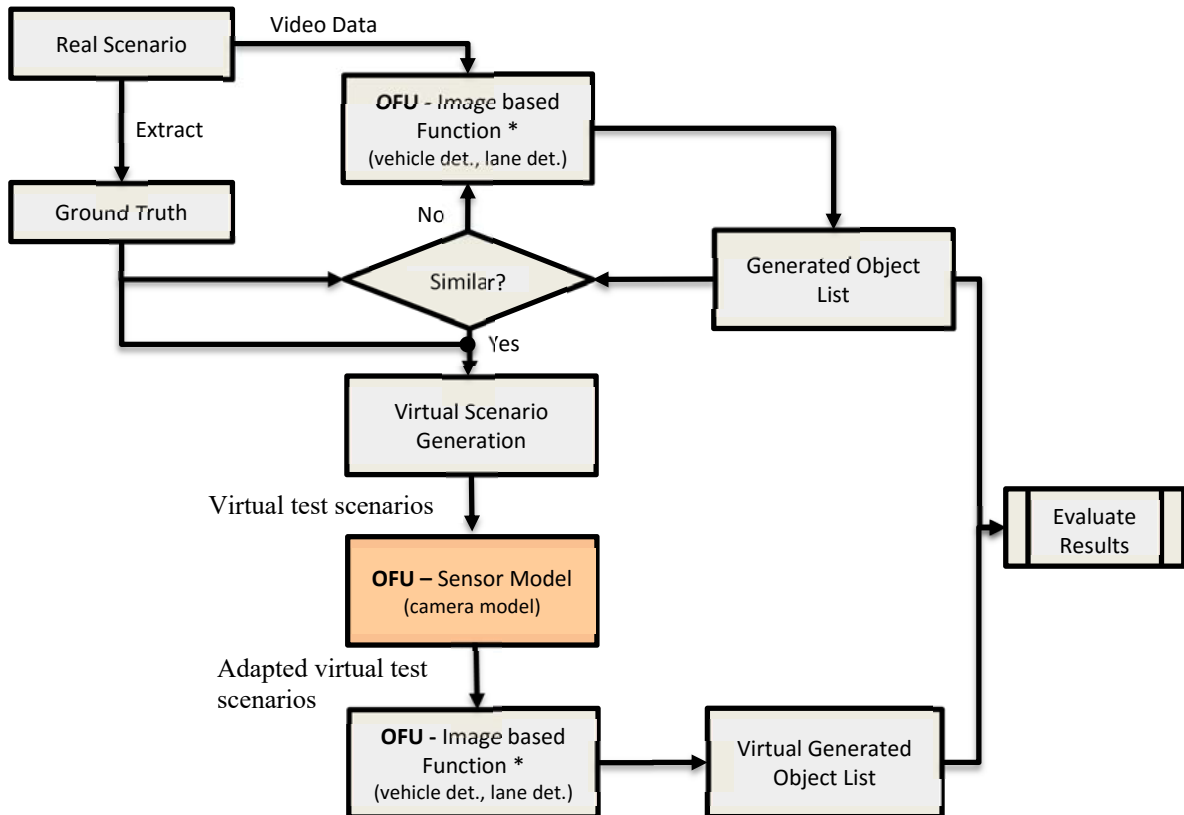


Fig. 2 OFU – Sensor models coupled with integration platforms for generating adapted virtual test scenarios

### 1.3. Expected results

Currently we have made good progress in setting up our experiment and in building up all the necessary missing pieces. A noticeable progress has been made in camera sensor modeling and in its implementation as *OFU* in integration platforms like CarMaker from IPG. We have also progressed in the development and integration of image based ADAS functions like vehicle and lane detection into a *OFU*. Our remaining tasks can be summarized in further refinement an implementation of *OFU-Sensor Model* and *OFU-Image based function* in our previously defined architectures (figure 1 and 2) in order to come up with a feasibility study regarding the usage of virtually generated scenarios for image based functions performance testing and validation.